

**TARSONEMUS (ACARINA: TARSONEMIDAE) MITES PHORETIC ON  
THE SOUTHERN PINE BEETLE (COLEOPTERA: SCOLYTIDAE):  
ATTACHMENT SITES AND NUMBERS OF BLUESTAIN  
(ASCOMYCETES: OPHIOSTOMATACEAE)  
ASCOSPORES CARRIED**

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*Abstract.* — *Tarsonemus ips* and *Tarsonemus krantzi* attach to different parts of adult *Dendroctonus frontalis*. *T. ips* rides only under the thorax, *T. krantzi* mostly under the elytra. Over 85% of both tarsonemids carried ascospores of *Ceratocystis minor*; most individuals carried over 15 spores.

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*Ceratocystis minor* (Hedgcock) Hunt, the bluestain fungus disease associated with the southern pine beetle, *Dendroctonus frontalis* Zimmermann, is introduced into southern pines by attacking beetles. Although the fungus can be isolated from bodies of attacking *D. frontalis*, the phoretic mites *Tarsonemus ips* Lindquist and *T. krantzi* Smiley and Moser were documented as the major sources of inoculum (Bridges and Moser, 1983). Both mite species live and develop beneath pine bark, feeding on blackish areas of the bluestain fungus that contain numerous fruiting bodies. These black areas produce many ascospores that may stick to arthropod exoskeletons. But because *D. frontalis* larvae migrate to the outer bark to pupate, the eclosing brood adults never come in contact with these sticky ascospores (Bridges and Moser, 1983). Though the *D. frontalis* pupae do not harbor phoretic mites, the brood adults emerge through the outer bark and often pick up *Tarsonemus* females that are carried to the next tree attacked (Roton, 1978). These mites may carry large numbers of ascospores in special pouches called sporothecae, located under tergite 1 on both sides of the mites (Moser, 1985).

The purpose of this study was to sample *Tarsonemus*-carrying southern pine beetle adults reared from *Pinus taeda* to determine whether the two tarsonemids ride at various locations on beetle bodies, the number of mites with and without ascospores, and how many ascospores each of the two *Tarsonemus* species carry.

#### MATERIALS AND METHODS

One loblolly pine (*Pinus taeda* L.) infested with *D. frontalis* was cut during each of the months of February, May, August, and December 1980. The trees were from a natural stand about 35 years old in the Catahoula Ranger District of the Kisatchie National Forest. Trees were felled when the *D. frontalis* broods were in the pupal stage in the outer bark.

Samples were taken from the bole area where the pupal stage was most con-

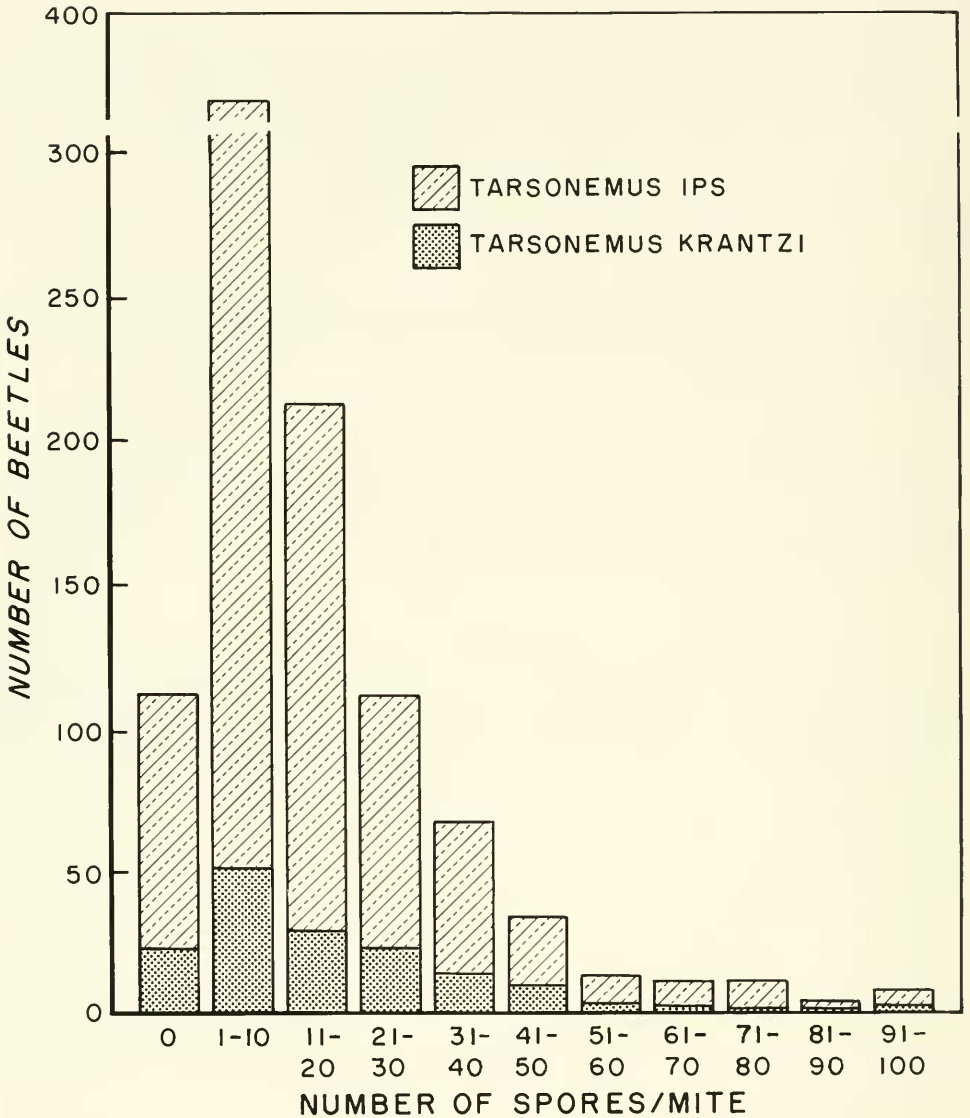


Fig. 1. Number of ascospores/mite.

centrated and where competition from other bark beetle species was least. Typically, the sample area extended 5 m through 11 m above ground level. No attempt was made to normalize infested bole heights within trees (McClelland et al., 1979) because it was not our objective to sample tree populations systematically. Five bolts were cut from each infested tree. Bolts spaced 1 m apart along the bole were trimmed so that each contained 2880 cm<sup>2</sup> of bark area. This material was placed in individual rearing cans inside the laboratory and kept at about 20°C and 50% relative humidity. The can interiors were dark with little or no air movement. Ten beetles with phoretic *Tarsonemus* mites attached to their coxae were collected from each bolt during the peak emergence period. These mites were then removed

from each beetle and temporarily mounted on slides with lactophenol as a clearing and mounting medium. Those *Tarsonemus* mites under the elytra were then removed and likewise mounted. The number of each mite species was then counted and tallied as to body location and species. *Ceratocystis minor* ascospores were counted on each mite.

Analyses of variance were performed on mites/beetle and spores/mite to detect differences due to species of mite and location on the infested tree. A split plot design was used in which tree was the blocking factor (3 df), location on the infested tree was the whole plot factor (4 df), and mite species was the split-plot factor (1 df).

### RESULTS

There was no significant difference in the number of mites/beetle or spores/mite of either species of mite collected from various heights.

There were differences in the location of each species of mite on the beetles. *T. ips* was found only under the thorax, but 79.9% of *T. krantzi* were found under the elytra.

There were more *T. ips* in the samples (4.78/beetle to 0.82 for *T. krantzi*) because beetles were selected on the basis of whether mites were present on the thorax. Therefore, from this biased sample we cannot determine whether the beetles carried more *T. ips* than *T. krantzi*.

Most mites carried *C. minor* spores. Of 164 *T. krantzi* examined, 85.4% carried spores. Of 956 *T. ips* examined, 88.4% carried spores. For *T. krantzi*, 87.9% of mites on the thorax and 84.7% of mites under the elytra carried *C. minor* spores. *T. krantzi* found on the thorax carried 18.4 spores/mite; those on the elytra carried 18.1 spores/mite.

The number of spores/mite did not differ significantly between *T. krantzi* (18.2) and *T. ips* (15.5). The number of spores/mite ranged from 0–99. Although the average number of spores/mite exceeded 15, most mites carried less than 10 (Fig. 1).

### DISCUSSION AND CONCLUSIONS

Because a substantial majority of both tarsonemid mites carry *C. minor* ascospores, it appears that both could infect a tree with the fungus. This confirms our earlier conclusions that phoretic mites vector *C. minor* to southern pine beetle infested trees (Bridges and Moser, 1983). Since both mite species carry equal numbers of spores, both have the potential to participate equally in the vector process. Our results show that, for the most part, the two mite species attach to different parts of the beetles.

### LITERATURE CITED

- Bridges, J. R. and J. C. Moser. 1983. Role of two phoretic mites in transmission of bluestain fungus, *Ceratocystis minor* (Hedgcock 1906). *Ecological Entomol.* 8: 9–12.
- McClelland, W. I., F. P. Hain, and W. D. Mawby. 1979. Comparison of within-tree distributions and population estimation procedures for declining populations of *Dendroctonus frontalis* colonizing loblolly and shortleaf pine. *Environ. Entomol.* 8: 1037–1040.
- Moser, J. C. 1985. Use of sporothecae by phoretic *Tarsonemus* mites to transport ascospores of coniferous bluestain fungi. *Trans. Br. Mycol. Soc.* 84: 750–753.
- Roton, L. M. 1978. Mites phoretic on the southern pine beetle: When and where they attach. *Can. Entomol.* 110: 557–558.